

Electric Cable Barrier Gland

This invention concerns an electric cable barrier gland.

This invention has particular application to cable barrier glands of the type that are fitted to an electric cable to provide a barrier to prevent
 5 ingress of liquid, gas or solids into the interstices of the cable between the cable cores when the cable sheathing has been removed to enable the connection of the conductive elements of the cable cores to some electrical equipment or installation. Barrier glands of this type are commonly used in hazardous locations and must meet specific flameproof performance criteria
 10 to prevent the risk of explosion.

It is already known to provide such a cable barrier gland in which a hardenable compound is used to fill the interstices between the cable cores and this compound is confined within a liner, sleeve or pot through which the cores extend. Such barrier glands with filler compounds and sleeves or pots
 15 are known, and two particular arrangements are described in our GB Patents Nos. 2104306 and 2060281.

The manufacture of barrier glands requires accurate and close machining or production as there are prescribed limitations on any gap between unthreaded surfaces in a cable gland. Such gap is commonly
 20 referred to as the flame gap and requirements in cable glands are specified in British Standards No. 4683 and No. 5501 of 1971 (Parts 1 & 5) as well as in other Standards issued by regulatory or approval testing authorities.

In our GB Patent No. 2104306 we proposed to overcome certain problems relating to the tolerances required by using a deformable sleeve or
 25 lining into which the hardenable material is packed to provide the barrier seal around the cores. The arrangement is such that the deformable sleeve or lining is intended to expand radially on assembly and compression of the gland so that the sleeve or lining is forced into sealing engagement with the complementary unthreaded part of the gland to ensure that there is no flame
 30 path. However, in use of the compound material, this presents difficulties in the field because such compound is normally made up from two separate materials which have to be mixed together, one being a resin and the other being a catalyst hardener. The mixture is of a putty-like consistency but ambient temperature variations effect consistency and hardening or curing
 35 times, and handling of the materials may be under adverse or extraordinary field conditions.

When a deformable sleeve or lining is used in a gland and subject to filling with a compound, local deformation of the sleeve may arise presenting problems during assembly. In addition, the compound may be spread over the external face of the sleeve or lining during assembly and
5 restrict adequate sealing engagement on completion and compression of the gland.

It is an object of this invention to provide an improved electric cable barrier gland by the construction of which such difficulties can be alleviated in a simple and effective manner.

10 According to one aspect of the invention an electric cable barrier gland comprises a hollow entry body, a substantially rigid barrier sleeve received within the entry body for containing a hardenable compound surrounding an exposed core of a cable extending through the entry body, the barrier sleeve having intermediate its ends first and second external
15 shoulders facing in opposite directions, a seal mounted on the barrier sleeve between the first external shoulder and an internal shoulder of the entry body, and compression means surrounding an end portion of the barrier sleeve within the entry body and engageable with the second abutment shoulder for urging the barrier sleeve axially to compress the seal and close
20 a clearance fit gap between the entry body and the barrier sleeve.

According to another aspect of the invention an electric cable barrier gland for a cable having a sheath enclosing at least one conductor core comprises an entry body having an entry bore with a counterbore at one end providing an internal shoulder, a substantially rigid barrier sleeve received
25 in the entry body and defining therewith a clearance fit gap, the barrier sleeve having first and second external shoulders, a hardenable compound disposable in the barrier sleeve to fill the sleeve and surround an exposed conductor core of a cable extending through the gland, an annular seal positioned on the barrier sleeve between the internal shoulder of the entry
30 body and the first external shoulder of the barrier sleeve, and a hollow compression member surrounding the barrier sleeve within the counterbore and engageable with the second external shoulder of the barrier sleeve, the compression member being arranged for axial movement relative to the entry body for urging the barrier sleeve axially to compress the seal and
35 close the clearance fit gap between the entry body and barrier sleeve.

By this feature of the rigid barrier sleeve located in a bore in the entry body with the seal acting therebetween, the potential flame path provided by the clearance fit gap is closed.

Conveniently, in known manner, the barrier sleeve may be of brass or
5 other suitable metal. However, the barrier sleeve may be of a selected plastics material providing a transparent or translucent portion as described and claimed in our co-pending UK Patent Application No.2258567-A.

By this feature of the plastics barrier sleeve with transparent or translucent portion, a visible check on the disposition of the compound can
10 be carried out either during assembly of the gland, or after by disassembly of the completed gland once the compound has hardened. Such visible check will show any discontinuities in the packing of the compound around the core, and any inconsistencies in the mixing of the compound by streaking or non-uniform colouration.

15 The plastics material should be resistant to cracking or melting in the range -20°C to 90°C . In addition, the plastics material should not be readily combustible. Suitable plastics materials include polycarbonates.

Preferably, the barrier sleeve has a right cylindrical sleeve portion on which the seal is mounted. Conveniently, when the barrier sleeve is made of
20 a plastics material, the cylindrical sleeve portion provides a transparent or translucent tubular wall.

By this arrangement, the seal engages both the cylindrical face of the sleeve portion and the shoulder and the bore of the entry body to ensure complete sealing of the barrier sleeve to the entry body when the gland is
25 assembled.

Preferably, the seal is of suitable elastomeric material such as neoprene, nitrile or silicone rubber and which has an operating temperature range of from -20°C to 90°C .

The gland may further comprise means for clamping an armour or
30 earth element of the cable sheath. The clamping means preferably comprises a clamping ring arranged to seat over that end of the compression member remote from the barrier sleeve with the armour or earth element of the cable sheath clamped therebetween.

The compression member and clamping ring are preferably urged
35 axially by threaded engagement of a compression body with the entry adaptor. In this way, the seal is compressed and the armour or earth

element clamped when the compression body is tightened up on the entry body.

The gland preferably also comprises a seal nut mounting a cable seal engaging the external face of the cable sheath and compressed by threaded engagement of the seal nut with the compression body.

By this arrangement of the various parts of the barrier gland, the barrier sleeve and the compression member extend co-axially and the core with the compound therearound are enclosed thereby so that, on assembly of the gland with the compound mixture in place prior to hardening, the tightening of the compression body on the entry body applies pressure to the compound mixture confined around the core and compresses the seal on the barrier sleeve to close any clearance gap between the assembled non-threaded part of the entry body, the barrier sleeve and compression member.

Other particular features of the invented barrier gland will be explained later herein with reference to an exemplary embodiment showing a simple arrangement with a cable having two conductor cores.

As will be appreciated, cables may be of different types with various kinds of sheath and numbers of conductor cores and, in some cases with separate earthing conductors. Furthermore, dependent on the type of electrical equipment for which the barrier gland is to be connected and used, various designs or styles of entry adaptor may be required.

This invention provides a simple construction ensuring a complete peripheral seal between the barrier sleeve and the entry adaptor to preclude the possibility of a flame gap whilst accommodating manufacturing or production clearance tolerances.

An exemplary embodiment of a cable barrier gland according to this invention will now be described with reference to the accompanying drawings wherein:-

FIGURE 1 is a longitudinal section through an assembled "made-off" barrier gland in which the compound is in situ;

FIGURE 2 is a section similar to that of Figure 1 with certain parts omitted for clarity;

FIGURE 3 is a cross-sectional view in the plane A-A of Figure 2;

FIGURE 4 is an exploded sectional view of the component parts for the gland entry side of the gland; and

FIGURE 5 is an exploded sectional view of the component parts for the cable seal and compression side of the gland.

With reference to the accompanying drawings, in this exemplary embodiment, the electric cable 1 comprises two conductor cores 2a,2b surrounded by an inner sheath 3 and, in known manner packing or filling material would separate the cores 2a,2b within the inner sheath 3. An armour or earthing element 4 extends between the inner sheath 3 and an outer sheath 5. As will be appreciated by those familiar with this field, there are various types and sizes of cable with different numbers of cores, and the cable 1 is only one type to which this invention has application.

As shown in Figure 4, on the entry side of the gland the component parts comprise an entry adaptor 6, a barrier seal 7, a barrier sleeve 8 and a ferrule 9 which are for assembly on the entry side of electrical equipment (not shown). On the cable seal and compression side, the component parts as shown in Figure 5 comprise a clamping ring 10, a compression nut 11, a cable seal 12 with washer 13 and a seal nut 14 in the form of an end cap. All of these parts are arranged and adapted to be co-axially assembled around the cable 1 to provide the completed "made-off" barrier gland as depicted in Figure 1 and as will be described later herein.

The entry adaptor 6 has an annular body portion 6a formed with a flatted flange 6b for engagement by a spanner or like tool to rotate the adaptor. One end of the adaptor 6 has a cylindrical bore 6c and an external male thread 6d terminating in a shoulder 6e. This one end of the adaptor 6 is for threaded engagement with a complementary threaded bore or bushing (not shown) in the electrical equipment in known manner. The other end of the adaptor 6 has a coaxial counterbore 6f terminating in an internal shoulder 6g with this end having an external thread 6h.

The barrier seal 7 is of annular form sized to fit on the barrier sleeve 8 and is suitable elastomeric or resilient material such as Neoprene or Silicone. The outer diameter of the seal 7 is complementary to the counterbore 6f and in the assembled gland the seal 7 is arranged to seat against the shoulder 6g.

In this exemplary embodiment, the barrier sleeve 8 is made of a strong plastics rigid material such as clear polycarbonate. The sleeve 8 may be machined from a rod of plastics material or it can be a moulding. The barrier sleeve 8 has an annular flange 8a extending from a shoulder 8b. A

sleeve portion 8c of relatively thin wall thickness extends from the shoulder 8b with the outer diameter being a sliding fit in the bore 6c of the entry adaptor 6. The seal 7 fits over the sleeve portion 8c and in the assembled gland (Figure 1) the seal 7 is seated between the shoulders 6g and 8b. The plastics material is selected so that the thin wall of the sleeve portion 8c is transparent or translucent so that the user on assembly or an inspector can view the compound material 16 or cores 2a,2b located within the bore 8d of the barrier sleeve 8.

The end of the barrier sleeve 8 opposed to the sleeve portion 8c is larger than the sleeve portion 8c and provides a cylindrical outer face 8e of diameter complementary to an inner bore 9a of the ferrule 9. This end of the barrier sleeve 8 has a frusto-conical shaped entry bore 8f tapering into the sleeve bore 8d.

The ferrule 9 has a body 9b from which extends an annular flange 9c providing opposed radial abutment faces 9d and 9e. The ferrule 9 has a tubular portion 9f extending from the flange 9c and adjacent to the flange 9c there is an external annular recess 9h seating an O-ring seal 15. The outer diameter of the portion 9f is complementary to the bore 6f of the adaptor 6 so that in the assembled gland (figure 1) the tubular portion 9f is received and engaged between one end of the adaptor 6 and one end of the barrier sleeve 8.

The cylindrical bore 9a of the ferrule 9 leads to a tapered portion 9i leading to a smaller cylindrical entry bore 9j to which, in use the cable 1 is presented. The entry bore 9j is in an entry portion 9k extending from the flange 9c with the portion 9k having an external clamp face 9l which is of frusto-conical shape tapering from the flange 9c to the end face 9m of ferrule.

With reference now to Figure 5, there is shown the clamping ring 10 which has a cylindrical outer face 10a and a tapering inner clamp face 10b complementary to the clamp face 9l of the ferrule 9. The clamping ring 10 has opposed abutment faces 10c and 10d arranged for respective engagement in the assembled gland with abutment face 9e of the ferrule 9 and an internal shoulder 11a of the compression nut 11.

The compression nut 11 has a body 11b formed with flats 11c for engagement by a spanner or the like. One end of the nut 11 has an internal thread 11d for threaded engagement with the thread 6h of the adaptor 6, and

the other end of the nut 11 has an external thread 11e for engagement with the internal thread 14a of the end cap nut 14.

The cable seal 12 with the washer 13 are arranged to be seated in an annular recess 14b within the end cap nut 14. The washer 13 abuts against
5 the inner face 14c of an inward lip 14d at one end of the end cap nut 14 through which the cable 1 is first entered in use during assembly of the gland.

In addition to the component parts of the gland as just described, there is the hardenable compound which is provided by two materials to be
10 mixed together. Usually the materials are an epoxy resin and a hardener, and these have to be carefully mixed together by hand in a quantity sufficient to fill the space within the gland to form a barrier. The compound barrier 16 is shown in Figures 1, 2 and 3 of the drawings.

The assembly and use of the invented barrier gland will now be
15 described.

In order to connect the cable 1 to the electrical equipment, the cable 1 is laid out and allowing for the required lengths of cores 2a,2b these are exposed cutting back the outer sheath 5, exposing the armour or earthing element 4 and then cutting back the inner sheath 3 so that it
20 projects beyond the outer sheath 5.

The end cap nut 14 with seal 12 and washer 13 assembled therein together with the compression nut 11 loosely threaded thereto are slid over the cable 1 to fit on the outer sheath and clear of the inner sheath 3 and cores 2a,2b. The clamping ring 10 is located over the exposed armour or
25 earth element 4 which is spread outwardly and trimmed back. At this stage the ferrule 9 may be brought into place temporarily to assist in correctly locating and trimming the element 4 as spread around the face 9f but trimmed so as to clear the abutment face 9e and not extending beyond the abutment face 10c of the clamping ring.

The cores 2a,2b are spread apart and the mixed two part compound material which has a consistency of putty or plasticine is applied into the crutch between the cores 2a,2b. The cores 2a,2b are then brought back towards each other and the compound material is packed carefully around the cores 2a,2b to avoid any voids and moulded into a sausage like shape.
30
35 Once this has been done and within the time limit before the compound material starts to harden, the barrier sleeve 8 with seal 7 is presented with

the entry bore 8f facing the free ends of the cores 2a,2b and is pushed over the cores 2a,2b with the compound packed therearound.

After cleaning away any excess compound exuding onto the external face of the barrier sleeve 8 and the seal 7, the free ends of the cores 2a,2b are passed through the entry adaptor 6 which has been screwed into the electrical equipment (not shown). The sleeve portion 8c of the barrier sleeve 8 is slid into the entry adaptor 6 to engage within the complementary bore 6c thereof with the seal 7 being between the shoulder 6g and the sleeve shoulder 8b. The end of the sleeve 8 having the entry bore 8f is pushed into engagement within the tubular portion 9f of the ferrule 9 with the sleeve 8 sitting within the internal bore 9a whilst the portion 9f is received within the internal bore 6f of the entry adaptor 6.

Once the parts are so loosely assembled and located, the compression nut 11 with the clamping ring 10 is then screwed into engagement with the thread 6h of the entry adaptor 6. On initial tightening of the compression nut 11, the parts are brought together axially so that the flange 8a of the barrier sleeve 8 abuts the end face of the ferrule portion 9f and the seal 7 is compressed. As the seal 7 is compressed, due to the axial forces applied, it is brought into face engagement between the unthreaded portions of the end adaptor and the barrier sleeve and completely seals these two parts together to act as a barrier between the two parts and closing any gap existing between the sleeve portion and the bore 6c of the entry adaptor.

After this initial assembly, the abutment face 9d of the ferrule engages the end face of the entry adaptor 6 with the O-ring seal 15 in sealing engagement between the ferrule 9 and the internal bore 6f of the entry adaptor 6.

As the compression nut 11 is tightened up the mastic compound material is subjected to pressure with a squeezing action so that it is compressed around the cores 2a,2b. Any excess compound exudes axially to extend along the cores 2a,2b and cover the exposed inner sheath 3 to provide the barrier of compound 16 within the gland. This squeezing action and the exudation of the compound material is not visible to the assembler, and the assembled gland has to be left in this condition for the required period specified for hardening of the compound.

After the compound has hardened, the integrity of the barrier 16 formed around the cores 2a,2b by the compound can be checked or verified by unscrewing the compression nut 11 and pulling the assembly with the barrier sleeve 8 away from the entry adaptor 6. Once the barrier sleeve 8 is clear of the entry adaptor 6, the disposition and condition of the compound 16 is visible through the translucent sleeve portion 8c and any voids or discontinuities or discrepancies in the compound barrier can be seen. By such visible inspection, an important safeguard check can be made avoiding destructive testing.

Conveniently, the visible check can be done if required before the final connection to the electrical equipment. After such check, the assembly is completed by bringing the cable seal 12 and the seal nut 14 into threaded engagement with the external thread 11e of the compression nut 11.

Alternatively, for on-site inspection of an installation, the visible check can be carried out by partial disassembly of the gland thereby avoiding expensive destructive checks.

In the foregoing exemplary embodiment, the barrier sleeve is of plastics to give the visibility advantage of the transparent or translucent portion mentioned. However, this is not essential and the barrier sleeve may be of metal such as brass and the advantages in using the seal mounted on the barrier sleeve are obtained.

As will be appreciated, various modifications to the arrangement and type of compression nut and/or cable seal member with end cap nut and/or armour clamping ring and/or earthing connection are envisaged and within the scope of this invention. In addition, the shape and axial length of barrier sleeve may be adapted to suit various types of entry adaptor. Furthermore, the O-ring seal mounted on the ferrule and engaging the entry adaptor may be omitted as the primary seal is that mounted on the barrier sleeve. Other types of cable seal may be used to suit the kind of cable and installation requirements.



Claims:

1. An electric cable barrier gland for a cable having a sheath enclosing at least one conductor core comprises an entry body having an entry bore with a counterbore at one end providing an internal shoulder, a substantially
5 rigid barrier sleeve received in the entry body and defining therewith a clearance fit gap, the barrier sleeve having first and second external shoulders, a hardenable compound disposable in the barrier sleeve to fill the sleeve and surround an exposed conductor core of a cable extending through the gland, an annular seal positioned on the barrier sleeve between the
10 internal shoulder of the entry body and the first external shoulder of the barrier sleeve, and a hollow compression member surrounding the barrier sleeve within the counterbore and engageable with the second external shoulder of the barrier sleeve, the compression member being arranged for axial movement relative to the entry body for urging the barrier sleeve
15 axially to compress the seal and close the clearance fit gap between the entry body and barrier sleeve.
2. A gland according to Claim 1 wherein the barrier sleeve is made of metal.
3. A gland according to Claim 1 wherein the barrier sleeve is made of
20 plastics material.
4. A gland according to Claim 3 wherein the barrier sleeve has a transparent or translucent portion.
5. A gland according to Claim 3 or Claim 4 wherein the plastics material is resistant to cracking or melting in the range -20°C to 90°C and/or is fire
25 resistant.
6. A gland according to any one of Claims 3 to 5 wherein the plastics material is polycarbonate.
7. A gland according to any one of the preceding Claims wherein the barrier sleeve has a right cylindrical sleeve portion on which the seal is
30 mounted abutting the first shoulder.
8. A gland according to any one of the preceding Claims wherein the second shoulder is provided by an annular flange that extends from the first shoulder and is received in the counterbore with the compression member abutting the second shoulder on one side of the flange remote from the seal.
- 35 9. A gland according to any one of the preceding Claims wherein the seal is made of elastomeric material.



10. A gland according to Claim 9 wherein the elastomeric material is selected from the group comprising neoprene, nitrile and silicone rubber.
11. A gland according to Claim 9 or Claim 10 wherein the elastomeric material has an operating temperature range of from -20°C to 90°C.
- 5 12. A gland according to any one of the preceding Claims wherein an annular seal is positioned on the compression member for sealing the compression member within the counterbore.
13. A gland according to any one of the preceding Claims wherein the compression member is adapted for axial movement relative to the entry
- 10 body by engagement of a compression body with the entry body.
14. A gland according to any one of the preceding Claims wherein the gland further comprises means for clamping an armour or earth element of the cable sheath.
15. A gland according to Claim 14 wherein the clamping means comprises
- 15 a clamping ring arranged to seat over that end of the compression member remote from the barrier sleeve with the armour or earth element therebetween.
16. A gland according to Claim 15 wherein the clamping ring and compression member have complementary internal and external tapering
- 20 clamp faces.
17. A gland according to Claim 15 or Claim 16 wherein the clamping ring is arranged for axial movement relative to the compression member for clamping the armour or earth element between the opposed clamp faces.
18. A gland according to Claim 17 as dependent on Claim 13 wherein the
- 25 clamping ring is adapted for axial movement relative to the compression member by engagement of the compression body with the entry body
19. A gland according to any one of the preceding Claims wherein the gland further comprises a seal nut mounting a cable seal for sealing an outer sheath of the cable.
- 30 20. A gland according to Claim 19 as dependent on Claim 13 wherein the cable seal is arranged to be compressed by axial movement of the seal nut relative to the compression body.
21. An electric cable barrier gland comprises a hollow entry body, a substantially rigid barrier sleeve received within the entry body for
- 35 containing a hardenable compound surrounding an exposed core of a cable extending through the entry body, the barrier sleeve having intermediate its



ends first and second external shoulders facing in opposite directions, a seal mounted on the barrier sleeve between the first external shoulder and an internal shoulder of the entry body, and compression means surrounding an end portion of the barrier sleeve within the entry body and engageable with

5 the second abutment shoulder for urging the barrier sleeve axially to compress the seal and close a clearance fit gap between the entry body and the barrier sleeve.